AFFIDAVIT OF DANIEL DAVIS, P.E.

COUNTY OF NASSAU)
SS:
STATE OF NEW YORK)

Daniel Davis, being duly sworn, deposes and says:

1. At all times between 1989 and 1998 I was the Commissioner of the Town of Hempstead Water Department ("Water District"). Amongst my responsibilities as Commissioner was the management of the Bowling Green Estates Water District in the Town of Hempstead ("Bowling Green"). I was responsible for the day to day operation of Bowling Green and I was fully aware of all operational issues and capital projects done at Bowling Green during my tenure as the Commissioner.

2. In 1989, Bowling Green and all other public water suppliers were required to do periodic testing of the quality of the public water supply. During the course of this routine sampling at Bowling Green in 1989, the presence of Trichloroethylene ("TCE") and Tetrachloroethylene ("PCE") was detected at Bowling Green wells.

3. In response to the sampling results, Dvirka and Bartilucci Consulting Engineers ("D&B") was commissioned by the Water District to evaluate treatment options and to recommend a long term treatment option for the TCE and PCE contamination found in the Bowling Green wells.

4. In November of 1989, D&B issued a report entitled Town of Hempstead Department of Water Bowling Green Water District Well 1 and 2 VOC Treatment Process and Evaluation. In this report, D&B evaluated the treatment options available at Bowling Green and did a comparative analysis between the options ("D&B Report").

Specifically, D&B evaluated two treatment options: (1) air stripping towers; and (2) carbon absorption systems. Following its evaluation, D&B recommended the carbon absorption system as a long term remedy for the VOC contamination at Bowling Green.

5. The D&B report was maintained by the Water District as a business record during my tenure as Commissioner. Attached hereto as Exhibit 1 is a true and accurate copy of the 1989 D&B Report.

6. Between April and June of 1990, there was a debate between D&B and the Department of Health concerning the use of carbon absorption versus air stripping at Bowling Greene. Both Nassau County Department of Health and the New York State Department of Health evaluated the proposed carbon absorption system and provided input on the system. Initially, the Department of Health recommended air stripping over carbon absorption as the long term solution to the VOC contamination at Bowling Green. After considerable debate, the Department of Health accepted the D&B recommendation to install the carbon absorption system at Bowling Green and approved the plans for the granulated activated carbon treatment system ("GAC Treatment System") in late June of 1990.

7. Attached hereto as Exhibits 2, 3, 4, and 5 are a chain of correspondence between D&B and the Department of Health concerning the evaluation of treatment options at Bowling Green and the ultimate approval of the GAC Treatment System to address the TCE and PCE contamination at Bowling Green. These are true and accurate copies of the correspondence which I would have seen at the time.

8. The only governmental agency involved in the construction of the GAC Treatment System was the Department of Health. At no time did the United States

Environmental Protection Agency ("EPA") have any involvement with the approval, design, construction or funding of the GAC Treatment System.

9. After approval of the GAC Treatment System by the Department of Health was received, the construction of the GAC Treatment System was put out to bid and a contract was awarded to the low bidder, E.B.C. Corp ("E.B.C.") on July 16 1990. The E.B.C. contract was for $396,466 for construction of the GAC Treatment System at Bowling Green.

10. Attached hereto as Exhibits 6 and 7 are true and accurate copies of the Board Resolution authorizing E.B.C. to commence work and awarding E.B.C. the contract.

11. On December 10, 1990, the GAC Treatment System was fully constructed and D&B sought permission from the Department of Health to operate the GAC Treatment System at Bowling Green. At that time, D&B wrote to the Department of Health requesting approval for the operation of the system which was completely constructed as of December 10, 1990. See D&B Letter attached as Exhibit 8.

12. The GAC Treatment system was not intended to be a temporary system. It was the Water District's intent to construct a system that would permanently address the contamination found in the Bowling Green wells. Moreover, the Department of Health also strenuously argued for the implementation of a permanent remedy for Bowling Green in 1990.

13. In the fall of 1994 a new building was constructed to house the GAC Treatment System and allow its year round use.

14. To the best of my knowledge the GAC Treatment System remains in use to this date as a part of the remedial system at Bowling Green. Specifically the GAC Treatment

System is used to polish the water after it is initial treated in the air stripping tower that was constructed in 1995.

15. On or about May 2, 1995, I became aware of a public hearing scheduled by the New York State Department of Conservation ("NYSDEC") on May 16, 1995. NYSDEC was scheduled to discuss the presence of VOC contamination in the groundwater at and around the New Cassel Industrial Area ("NCIA").

16. My initial reaction was to attend the meeting and demand reimbursement of the costs of the GAC Treatment System from NYSDEC. I attended the meeting with the Town Attorney to make this demand upon the NYSDEC. See Water District inter-departmental memo at Exhibit 9.

17. At the public hearing I received assurances that the recovery of the cost of the construction and operation of the GAC Treatment System would be pursued by NYSDEC against the parties responsible for the contamination at NCIA on behalf of the Water District, and the Water District would ultimately be reimbursed by NYSDEC for the cost of the GAC Treatment System construction and operation.

18. I personally attended the May 16, 1995 NYSDEC public hearing. The meeting was attended by the NYSDEC and Department of Health personnel identified in the Public Hearing Agenda which is appended to this Affidavit at Exhibit 10.

19. At this public hearing, I became aware of the very serious nature of the groundwater contamination originating in the NCIA and its likely impact upon the Bowling Green wells. This was of great concern to me as I had an obligation as the Commissioner of the Water District to safeguard the quality of the Bowling Green water.

20. At the public hearing, I received verbal assurance that NYSDEC would assist in the funding of a necessary supplemental remedial systems to protect the quality of the Bowling Green water. I was specifically informed that the costs would be eligible for reimbursement under the New York State Superfund Program.

21. Following the public meeting I instructed D&B to identify further treatment options for Bowling Green on an expedited basis. Before the end of May, 1995, D&B was recommending the installation of an air stripper tower to work in conjunction with the previously installed GAC Treatment System.

22. By letter dated May 23, 1995, the Presiding Supervisor of the Town of Hempstead, wrote to NYSDEC Director Michael J. O'Toole demanding, amongst other things, reimbursement for the cost of treatment with the GAC Treatment System and funding for the capital cost of supplementing the GAC Treatment System with an air stripper tower. I participated in the review and drafting of this letter. A true and accurate copy of the letter is appended hereto as Exhibit 11.

23. On or before May 30, 1995, a determination was made by me to go forward with the D&B recommendation, and to purchase and construct an air stripper tower to supplement the GAC Treatment System. The installation of the air stripper tower was placed on a "fast track" and D&B was instructed to get it done expeditiously. This fact was conveyed to the public on May 30 and 31, 1995. See attached inter-departmental memorandums at Exhibits 12 and 13.

24. On May 30, 1995, I received a quotation package from D&B which originated from Hydro Group for the air stripper tower. See true and accurate copy of D&B facsimile with attachment at Exhibit 14.

25. On June 7, 1995, I signed the Purchase Requisition for the purchase of the air stripper tower. See Purchase Requisition signed by me on June 7, 1995 at Exhibit 15.

26. The air stripper tower was expeditiously purchased from Hydro Group and delivered to the Water District on July 20, 1995. See Delivery Receipt at Exhibit 16.

27. Once the air stripper Purchase Requisition was signed on June 7, 1995, D&B was instructed to start construction activity of the necessary physical structure for the air stripper tower in motion, including the concrete pad upon which the air stripper tower would be erected.

28. The first physical onsite activity associated with the construction of the air stripper tower occurred between June 12, 1995 and June 13, 1995. At that time D&B hired Warren George, Inc. ("WGI") to drill three soil borings at the Bowling Green well field.

29. These soil borings were done with a large drilling truck, similar to the type of equipment which would be used to drill a household well. Between June 12-13, 1995, this rig drilled three borings. These borings were four inches in diameter and went down thirty two feet below the ground surface. These borings were done directly below the area that the concrete slab for the air stripper tower was to be erected. The purpose of the borings was to determine the soil conditions below the proposed area for the concrete slab on which the air stripper tower was to be erected.

30. In this case, the soil borings were absolutely necessary as the air stripper tower is a massive piece of equipment, standing over 30 feet in height and weighing several tons. Accordingly, knowing what the soil conditions under the footprint of the pad that the tower is attached to was required for this construction project.

31. The results of the soil borings were incorporated into a report by WGI. A true and accurate copy of the WGI report is appended to this affidavit as Exhibit 17. The report specifically confirms that the physical on-site work was done by WGI between June 12 and 13, 1995 in connection with the construction of the air stripper tower at Bowling Green.

32. As with all construction projects in Long Island, these soil borings were a necessary first step. Taking soil borings at the Bowling Green Water District was a necessary physical on-site activity.

33. The cost of the WGI soil borings was subsequently reimbursed from the New York State Superfund as part of the capital cost of the air stripper tower which was classified as a remedial system by NYSDEC.

34. On June 21, 1995, NYSDEC Director Michael J. O'Toole confirmed in writing that the capital costs of the proposed supplemental water treatment system would be paid out of the State Superfund Program. See O'Toole letter to Town of Hempstead Supervisor Peterson dated June 21, 1995 at Exhibit 18.

35. On June 28, 1995, I received a call from Jeff Trad of NYSDEC. He was the NCIA project engineer with NYSDEC at that time. Importantly, he confirmed that the capital cost of the air stripper tower would be paid as an expense that is part of the "remediation to clean the groundwater."

36. The specifics of the telephone conversation with Jeff Trad were incorporated into Inter-Departmental Memorandum dated June 28, 1995. A true and accurate copy of the Inter-Departmental Memorandum is attached hereto as Exhibit 19.

37. Following the initial physical on-site work done by WGI on June 12-13, 1995, the next round of physical on-site work was commenced on or about July 11, 1995 by Region Associates. Region Associates was the low bidder on the general construction contract.

38. Pursuant to the general construction contract, Region Associates was required to do general site work and construction of the concrete pad on which the air stripper tower would be erected.

39. After Region Associates won the bid, they were instructed by me to commence work on its phase of the construction project on July 11, 1995. This was incorporated into a letter from me to Region Associates dated July 7, 1995. A true and accurate copy of this letter is appended hereto as Exhibit 20.

40. My current recollection is that Region Associates complied with this directive and was over 25% complete with their construction activities at the end of July, 1995. This was confirmed in the Region Associates invoice dated July 31, 1995. See Region Associates Invoice dated July 31, 1995 at Exhibit 21.

41. In addition to the physical on-site work done by WGI and Region Associates in June and July of 1995, additional on-site work was performed after July of 1995 by a number of additional contractors. This work included mechanical, electrical, and site work on the air stripper tower.

42. On March 23, 1998, I personally prepared a letter requesting 100% reimbursement of all costs associated with the construction of the air stripper tower from NYSDEC. These costs were to be repaid from the New York State Superfund as a remedial project. Included in the reimbursed costs were the costs of: (1) the WGI soil borings; (2) the Region Associates contract; (3) the mechanical contract; (4) the direct

costs of purchasing the air stripper and related equipment; (5) the electrical contract; (6) the site work contract; (7) DB engineering costs; and (8) other construction costs.

43. A detailed itemization of the costs and extensive backup documentation was provided to NYSDEC by the March 23, 1998 letter. I am personally aware that the letter and the extensive backup documents concerning the costs of constructing the air stripper tower were sent to the NYSDEC. A true and accurate copy of my March 23, 1998 letter is appended hereto as Exhibit 22.

44. All of the expenses identified in my March 23, 1998 letter were subsequently reimbursed by NYSDEC as remedial costs under the New York State Superfund, including the costs of the soil borings.

Dated March 27, 2009
Nassau County, New York

Daniel Davis

Sworn and subscribed before me this
27 day of March, 2009

Notary Public, State of New York

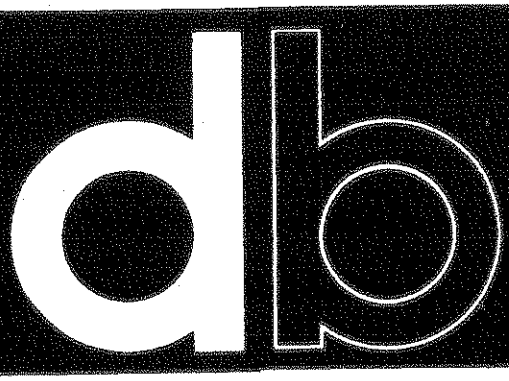
B JILL MURTHA
Notary Public - State of New York
NO. 01MU6179297
Qualified in Nassau County
My Commission Expires 12/24/11

Exhibit 1

Town of Hempstead
Department of Water
Bowling Green Water District

WELLS 1 AND 2
VOC TREATMENT
PROCESS EVALUATION

NOVEMBER 1989



Dvirka and Bartilucci
Consulting Engineers

TOWN OF HEMPSTEAD

BOWLING GREEN WATER DISTRICT

WELLS 1 AND 2

VOC TREATMENT PROCESS EVALUATION

NOVEMBER 1989

Dvirka and Bartilucci
Consulting Engineers
Syosset, New York

Executive Summary

Wells 1 and 2 at the Iris Place Pump Station have Volatile Organic Compound (VOC) concentrations approaching current New York State Maximum Contaminant Levels for potable water. The wells are critical to the operation of the Bowling Green Water District; consequently, immediate action is required to ensure that the wells remain operational at all times.

Air stripping and carbon adsorption were evaluated as possible treatment technologies for VOC removal. Carbon adsorption was recommended and has the following advantages:

- o Improved Treatment. Carbon will consistently provide treatment to below detectable limits for the volatile organics detected at Wells 1 and 2. Air stripping would be only marginally effective for a number of the compounds.
- o Proven Technology. More than 30 carbon adsorption systems are in service in Nassau and Suffolk Counties.
- o Noise. A carbon system is expected to have a lower impact on noise in the surrounding community.

The estimated project cost of the recommended carbon system is as follows:

Three (3) carbon adsorption units:	$ 600,000
Masonry Building w/foundation:	250,000
Site Work, Piping:	100,000
Two (2) New Well Pumps:	80,000
Two (2) Flow Control Valves:	10,000
Electrical:	60,000
Subtotal:	$1,100,000
Contingencies (5%):	50,000
Total Construction Cost:	$1,150,000
Engineering (9%):	100,000
Total Project Cost:	$1,250,000

Background

The Iris Place Pump Station serves the Bowling Green Water District in the Town of Hempstead. Samples collected from the supply wells at the site (Well Nos. 1 and 2) indicated the presence of several Volatile Organic Compounds (VOC) in concentrations approaching current New York State Maximum Contaminant Levels (MCLs) for potable water. Nitrates were also detected at Wells 1 and 2, although the concentrations were below the current MCL.

The Iris Place Pump Station is the primary source of water to the approximately 3015 customers served by the Bowling Green Water District. Operation of Wells 1 and 2 is critical to maintaining adequate service in the district for fire protection and during peak demand periods. Immediate action is required to provide a VOC treatment system to ensure that the wells remain operational at all times.

Existing System

The Iris Place Pump Station consists of Wells 1 and 2, a 2.0 million gallon ground storage reservoir, three (3) booster pumps and lime and chlorine feed equipment. Information on Wells 1 and 2, the reservoir and the booster pumps is summarized below:

Supply Wells

Well No. :	1	2
NYSDEC No.:	N8956	N8957
Depth (ft):	535	589
Capacity (gpm):	1400	1400
Motor Hp:	100	100
RPM:	1200	1200
Year Installed:	1972	1972
Auxiliary Power:	*	*

*Diesel Generator

Reservoir

Capacity (MG):	2.0
Diameter (ft):	100
Depth (ft):	35
Overflow El:	141.0
Construction:	Prestressed Concrete

Booster Pumps

Pump ID:	A	B	C
Capacity (gpm):	1500	1500	1500
Motor Hp:	100	100	100
RPM:	1800	1800	1750-2000
Speed:	Constant	Constant	Variable
Auxiliary Power:	*	*	*

*Diesel Generator

Levels of Contamination

The contaminant concentrations detected at Wells 1 and 2 during quarterly monitoring for 1989 are summarized below. Also shown are the current MCLs for each contaminant as listed in "Subpart 5-1: Public Water Supplies" of the New York State Sanitary Code.

Contaminant	MCL* (ug/l)	Concentrations (ug/l) Well 1			Well 2		
		1st	2nd	3rd	1st	2nd	3rd
Trichloroethylene	5	2	1	ND	2	2	1
Tetrachloroethylene	5	1	1	1	1	ND	ND
Dibromomethane	5	ND	ND	3	ND	ND	ND
Chloroform	5	ND	1	4	ND	ND	ND
Bromodichloromethane	5	ND	ND	2	ND	ND	ND
Bromoform	5	ND	ND	3	ND	ND	ND
Nitrates (mg/l)	10	3.7	0.9	1.9	1.7	1.6	0.2

Note: ND = Not Detectable

*Trichloroethylene, Tetrachloroethylene and Dibromomethane are listed as Principal Organic Contaminants (POC) in Subpart 5-1 and are subject to the 5 ug/l MCL stated therein. Chloroform, Bromodichloromethane and Bromoform are regulated separately in Subpart 5-1 under the Trihalomethane (THM) classification. The current regulations address THMs which occur as byproducts of disinfection, but provide no standard for THMs which contaminate the water supply from outside sources. The New York State Health Department recommends including contaminant THMs under the POC classification and designing for an MCL of 5 ug/l for these compounds. Future legislation may mandate this MCL for contaminant THMs.

detected by sampling. Pilot testing is required for the manufacturer to guarantee removal efficiencies for the contaminants.

Contaminant	Removal Eff. (%)	Current Inf. Conc. (ug/l)	Projected Eff. Conc. (ug/l)	Max.Allowable* Inf. Conc. (ug/l)
Trichloroethylene	95	2	<1	100
Tetrachloroetylene	95	2	<1	100
Dibromomethane	70	4	1	16
Chloroform	92	4	<1	62
Bromodichloromethane	89	2	<1	45
Bromoform	50	3	1.5	10

*For treated effluent not to exceed 5 ug/l

It is important to note the low removal efficiency of Bromoform for the air stripping system. Bromoform has a very low volatility and consequently, is extremely difficult to strip out of solution. Effluent from the stripping system as designed will likely exceed the recommended MCL for Bromoform (5 ug/l) if the raw water Bromoform concentration is greater than 10 ug/l.

The air stripping system for Wells 1 and 2 would include towers, blowers, pumps to deliver treated effluent to the reservoir and associated control and electrical equipment. Although a single air stripping system can be designed to serve both wells, it is not recommended due to the size of the equipment involved and the lack of back up treatment capability should the system be taken out of service for repair.

Two (2) complete air stripping systems would be required, one system (tower, blower and pump) for each well. Preliminary air stripping system design parameters are summarized as follows:

Towers	Pumps	Blowers
No. of Units: 2	No. of Units: 2	No. of Units: 2
Diameter (ft): 9.55	Type: Centrifugal	Type: Centrifugal
Packing Depth (ft): 15	Motor Hp: 50	Motor Hp: 30
Total Height (ft): 30	Total Hp: 100	Total Hp: 60

Raw water from Wells 1 and 2 would be discharged to the top of the two packed towers. Since the height of the towers (30 feet) is less than the depth of the existing ground storage reservoir (35 feet), modifications to the existing well pumps are not required. Treated water would be collected in an underground concrete clearwell beneath the towers and pumped to the existing reservoir by two centrifugal pumps. Process air would be provided by two centrifugal blowers.

Treatment of the contaminated air discharged from the towers is not expected to be required. The Nassau County Health Department requires air discharge permits for all air stripping systems. The decision to require off gas treatment is based on air modeling of the proposed discharge, its relation to adjacent properties, etc. Air stripping systems with raw water VOC concentrations similar to those at Wells 1 and 2 do not typically require off gas treatment.

The towers, pumps and blowers can be designed to operate year round in an exposed location, provided that proper draining procedures are employed when the system is not in operation for an extended period during freezing weather. Control panels, on the other hand, must be protected from the weather, either by installation in the existing pump station or construction of a separate enclosure. Since vandalism is expected to be a problem, a building is recommended to house the pumps, blowers and control and electrical equipment.

All equipment necessary for the operation of the air stripping system would be supplied through the manufacturer, with the exception of the following:

- Concrete pad
- Crane for installation
- Piping and wiring
- Modifications to existing electrical service
- Enclosure for control panels

The air stripping system can acquired in three ways: rental, purchase and lease/purchase.

Rental

The rental rate is $3,450/week plus $10,000 mobilization per unit for a minimum of 26 weeks. Since two systems are required, the cost for 1 year rental is approximately $380,000.

Purchase

The system can be purchased for $175,000 per unit. The total equipment cost for two units is $350,000. Items not included in this cost are the building and concrete clearwell, piping, wiring and modifications to the existing electrical service.

Lease/Purchase

A lease/purchase agreement is available in which 40% of the rental rate is applied towards purchase, excluding the mobilization charge.

An air stripping system can be operational by March 1990, provided an order is made to the manufacturer by the early part of December 1989. The item with the longest lead time is the control systems which often require 14-16 weeks. A March operating date is only feasible if the systems are purchased directly from the manufacturer or if the competitive bidding process is expedited.

o Carbon Adsorption System

Activated carbon adsorption is also effective in removing volatile organics from drinking water. It differs from air stripping in that virtually all (99.9%) contaminants are removed from the water until the adsorption capacity of the carbon bed is exhausted. The adsorptive ability of individual compounds vary

depending on their chemical and physical characteristics. The more difficult a compound is to adsorb, the faster the carbon bed is consumed.

The removal efficiency of the carbon system selected for Wells 1 and 2 is expected to be approximately 99% for the VOCs found in Wells 1 and 2. Effluent VOC concentrations are expected to be below detectable limits for the life of the bed.

As the carbon bed nears its useful adsorption capacity contaminants will begin to be detected in the system effluent. The carbon bed must be replaced before the effluent concentrations increase above acceptable levels.

Carbon systems on wells with VOC concentrations similar to those found at Wells 1 and 2 have operated for over 2 years without bed replacement. Carbon manufacturers have indicated that the bed life on these systems may extend to 4 years or more at current concentrations. A bed life of 3 years will be assumed for the carbon units serving Wells 1 and 2.

The Calgon Carbon Corporation is the leading manufacturer of activated carbon adsorption systems. They provide both packaged treatment units and activated carbon replacement services.

Three (3) Calgon Model 10 adsorption units would be required to serve Wells 1 and 2. The flow capacity of each unit is approximately 1100 gpm; therefore, two (2) units would be required even if only one well is in operation.

The carbon units are closed vessels which operate at system pressure. Untreated water will be pumped from Wells 1 and 2, through the three carbon units and discharged to the existing ground storage reservoir. Clayton type control valves will be installed at Wells 1 and 2 to limit the discharge to about 1200 gpm. At 1200 gpm, hydraulic losses through the carbon system would be approximately 10-15 psi. Consequently, the existing pumps at Wells 1 and 2 would have to be replaced or restaged for a higher discharge pressure.

The existing well pumps are oil lubricated units which have been in service for approximately 18 years. Restaging the existing pumps to meet the new design conditions is expected to cost nearly as much as the installation of new pumps since the existing pumps would have to be pulled, additional stages added, existing motors rewound, etc. Two (2) new well pumps are recommended to replace the existing units at Wells 1 and 2 at an estimated cost of $40,000 per pump.

The carbon units come completely assembled and are skid mounted for ease of installation. The units are provided with pre-assembled piping sections for raw and treated water, utility water and compressed air, carbon transfer, and venting operations. A screen is provided on each unit to prevent accidental blowout of carbon into the distribution system. The following items are not furnished:

- Building and concrete pad
- Water and utility piping to units
- Wiring

Carbon systems have operated successfully in exposed locations; however, additional care must be taken when the systems are deactivated during low temperature periods. Draining the units will not eliminate the possibility of frost damage since the carbon itself retains a significant amount of moisture. Damage can be prevented by passing water through the units on a regular basis when the units are not operational. A maximum system shutdown of 6 hours is recommended to prevent freezing. Due to freezing problems and the possibility of vandalism, the carbon units would be enclosed in a building.

Direct purchasing of the carbon units is the only reasonable method of acquiring the system. Systems have been leased in the past, but the rental over a six month period exceeded the purchase price. The estimated cost of each Calgon Model 10 carbon unit is approximately $200,000, including delivery and installation. The total equipment cost for the three units recommended for the Iris Place Pump Station is estimated at $600,000.

A carbon adsorption system can be operational by March 1990 if the system is purchased directly from the manufacturer or if the competitive bidding process can be expedited.

Economic Evaluation

An economic comparison of air stripping and activated carbon adsorption is presented below. Capital costs are based on direct purchase from the equipment manufacturer and include a contingency

factor for problems unforeseen at this preliminary stage. Construction of a building to enclose the treatment equipment is included in the capital cost of each system.

Electrical costs for the air stripping alternative are based on two (2) 30 Hp blowers and two (2) 50 Hp pumps. Electrical costs for the carbon adsorption alternative are based on the additional 25 Hp required for each new well pump (50 Hp total). All electrical costs assume 10 hours per day and 365 days per year operation.

Annual Bed recharge costs assume $40,000 per Bed recharge, three (3) systems requiring Bed recharge, and a recharge frequency of once every three (3) years.

o Capital Costs

Item	Air Stripping	Carbon System
Equipment (w/installation)	$400,000	$ 600,000
Building	250,000	250,000
Site work, piping, etc.	100,000	100,000
New Well Pumps	0	80,000
Electrical	140,000	60,000
Contingencies (5%)	50,000	50,000
TOTAL CAPITAL COST	$940,000	$1,140,000

o Annual Operating Costs

Item	Air Stripping	Carbon System
Electrical (@ $0.10/kw-hr)	$50,000	$15,000
Maintenance	30,000	15,000
Bed Recharge	0	40,000
TOTAL ANNUAL COST	$80,000	$70,000

Recommended Alternative

A carbon adsorption system is recommended for volatile organic removal at the Iris Place Pump Station. Although the capital cost is expected to be higher for a carbon system as compared to an air stripping system, activated carbon has the following important advantages:

- o Improved Treatment. Carbon will provide effluent concentrations below detectable limits for the volatile organics detected at Wells 1 and 2. This includes Bromoform, which can cause difficulties for an air stripping system. The Bromoform concentration at the site is approximately 3 ug/l. The Health Department will require the selected process to be able to treat three times this amount or 9 ug/l. Since the Bromoform removal efficiency for the air stripping system is approximately 50%, the effluent concentration would be just under the MCL for the compound.
- o Proven Technology. Carbon adsorption is a proven technology for VOC removal from drinking water. The Suffolk County Water Authority (SCWA) has approximately thirty (30) Calgon Model 10 systems in service with more than 20 additional units planned in the next two years. Representatives of the SCWA spoke very highly of the existing systems and reported few problems.

- Operation. A carbon system has few operating components. Untreated water will be pumped through the units and into the existing reservoir. An air stripping system requires pumping from the well to the top of the tower and again from the clearwell to the existing reservoir. The carbon system is protected against accidental blowout of carbon into the distribution system.
- Noise. Noise control is of primary importance at the Iris Place Pump station since the station is located in a residential community. Air stripping systems require blowers, pumps and other equipment which can generate a significant amount of noise. A carbon adsorption system is a closed system which is designed to minimize noise generation.
- Water Quality Control. The Nassau County Health Department sampling requirements for the carbon adsorption system are summarized as follows. Analyses are to be performed at the influent and effluent of the carbon system.

Analysis	Frequency
Design Organic Contaminants	Monthly
Principal Organic Contaminants*	Quarterly
Bacteriological	Monthly
Physical and Inorganic	Annually

*As listed in Subpart 5-1 of the New York Sanitary Code

Estimated Project Cost

The estimated project cost of the carbon adsorption system recommended for Wells 1 and 2 is summarized below. The total cost includes an estimate of engineering fees and a contingency factor.

Three (3) Calgon Model 10 units:	$ 600,000
Masonry Building w/foundation:	250,000
Site work, Piping:	100,000
Two (2) New Well Pumps:	80,000
Two (2) Flow Control Valves:	10,000
Electrical:	60,000
Subtotal	$1,100,000
Contingencies (5%)	50,000
Total Construction Cost:	$1,150,000
Engineering (9%)	100,000
Total Project Cost:	$1,250,000

Health Department Approval Period

It is important to note that Nassau County Health Department (NCHD) Approval will be required for the recommended system. The approximate review time by the NCHD for previously approved carbon adsorption systems are as follows:

Applicant	First Submittal	Final Approval	Total Review Period
Hicksville W.D.	4/89	7/89	12 weeks
Franklin Sq. W.D.	11/88	7/89	32 weeks

Exhibit 2

Dvirka and Bartilucci
CONSULTING ENGINEERS
6800 Jericho Turnpike, Syosset, New York 11791 • (516) 364-9892

April 6, 1990

Nassau County Department of Health
240 Old Country Road
Mineola, NY 11501-4250

Re: Granular Activated Carbon
Treatment at Wells Number 1
and Number 2
Bowling Green Water District
(NCDH File #1431-90)
D&B No. 1014-E

Gentlemen:

In response to your letter dated March 30, 1990, (copy attached), plans and specifications were hand delivered to your office on March 13, 1990 for your review and approval. This letter notified your office of the Town's intention to start construction with the intent of the project being completed and approved for use by your department prior to the onset of summer.

Wells 1 and 2 at the Iris Place Pump Station have Volatile Organic Compound (VOC) concentrations approaching current New York State Maximum Contaminant Levels for potable water. The wells are critical to the operation of the Bowling Green Estates Water District; consequently, immediate action was required to ensure that the wells remain operational at all times.

Air stripping and carbon adsorption were evaluated as possible treatment technologies for VOC removal.

Carbon was chosen because it will consistently provide treatment below detectable limits for the volatile organics detected at wells 1 and 2. Air stripping would be only marginally effective for a number of the organic compounds.

The contaminant concentrations detected at wells 1 and 2 during quarterly monitoring for 1989 are summarized below, also shown are the current MCLs for each contaminant as listed in "Subpart 5-1: Public Water Supplies" of the New York State Sanitary Code.

Organic Contaminant	MCL* (ug/l)	Concentrations (ug/l) Well 1			Well 2		
		1st	2nd	3rd	1st	2nd	3rd
Trichloroethylene	5	2	1	ND	2	2	1
Tetrachloroethylene	5	1	1	1	1	ND	ND
Dibromomethane	5	ND	ND	3	ND	ND	ND
Chloroform	5	ND	1	4	ND	ND	ND
Bromodichloromethane	5	ND	ND	2	ND	ND	ND
Bromoform	5	ND	ND	3	ND	ND	ND

Note: ND = Not Detectable

Air stripping was analyzed as an alternative treatment method for VOC removal, however, the presence of bromoform reduced the removal efficiency of an air stripping system.

The projected removal efficiency of an air stripping system for wells 1 and 2 is summarized below. The effluent concentrations presented are based on the raw water VOC levels currently found at wells 1 and 2. Also shown are the maximum raw water VOC concentrations at which the treated effluent will not exceed the current MCL of 5 ug/l for the compounds.

Organic Contaminant	Removal Eff. (%)	Current Inf. Conc. (ug/l)	Projected Eff. Con. (ug/l)	Max. Allowable* Inf. Conc. (ug/l)
Trichloroethylene	95	2	<1	100
Tetrachloroethylene	95	2	<1	100
Dibromomethane	70	4	1	16
Chloroform	92	4	<1	62
Bromodichloromethane	89	2	<1	45
Bromoform	50	3	1.5	10

*For Treated effluent not to exceed 5 ug/l

You will note the low removal efficiency of bromoform for an air stripping system. Bromoform has a very low volatility and consequently, is extremely difficult to strip out of solution. Effluent from the stripping system as designed will likely exceed the recommended MCL for bromoform (5 ug/l) if the raw water bromoform concentration is greater than 10 ug/l.

Activated carbon adsorption was selective because of its ability to effectively remove volatile organics from drinking water.

It differs from air stripping that virtually all (99.9%) contaminants are removed from the water until the adsorption capacity of the carbon bed is exhausted.

The results of our analysis is summarized in the enclosed report entitled, "Wells 1 and 2 VOC Treatment Process Evaluation" dated November 1989.

In response to Item No. 2 of your letter. The word "design" should have been interpreted as fabrication of the Granular Activated Carbon (GAC) vessels as a unit, skid mounted, ready for transportation and built in conformance with applicable codes and regulations. The technical specifications provided by our office clearly define the design of the GAC Adsorption units including but not limited to, diameter, height, freeboard, flow rate, loading and material of construction.

With regard to Item No. 3, replacement of the existing well pumps would be required to meet the new design conditions for the installation of a GAC Adsorption System. The horsepower required to operate each deep well turbine pump motor would be increased to compensate for the increased headloss generated from the GAC Adsorption System while maintaining a constant flow of 1400 gallons per minute from each well.

The existing deep well turbine pumps are oil lubricated units which have been in service for approximately 18 years. Units of this age and construction would be required to be replaced with water lubricated units, irrelevant of the proposed GAC Adsorption System.

Furthermore, a representative from your office was present when the deep well turbine pump for well 2 was removed. Following the installation of the new pump and motor, the well was disinfected and sampled for bacteriological analysis on March 23, 1990 by the Town of Hempstead and by Donald Spiece (NCDOH) on March 26, 1990. The results of all bacteriological analysis was satisfactory. This procedure of notification was duly performed and implemented in accordance with common health department practice to maintain the same quality and quantity of potable water presently provided to the public.

Very truly yours,

Nicholas J. Bartilucci

NJB:mal
Enclosure

Exhibit 3

Dvirka and Bartilucci
CONSULTING ENGINEERS

6800 Jericho Turnpike, Syosset, New York 11791
516-364-9892 • Fax: 516-364-9045

June 14, 1990

Nassau County Department of Health
Bureau of Public Water Supply
240 Old Country Road
Mineola, New York 11501

Attention: Shahriar Taj-Taraghi
Public Health Engineer I

Re: Granular Activated Carbon
Treatment at Wells No. 1 and 2
Bowling Green Water District
NCDH File #1431-90
D&B No. 1014-E

Gentlemen:

On behalf of the Town of Hempstead, Department of Water, we are responding to your letter dated May 31, 1990. The numbers on the responses given below refer to the numbered paragraphs in your letter.

1. The Town of Hempstead recognizes that the contaminants in the raw water can be removed using either air stripping or carbon adsorption and that both methods are proven technology for this purpose. The choice of a carbon adsorption system was based upon the following:

   o Noise at the site cannot be increased beyond present levels. The constant noise of the water entering the air stripping units cannot be tolerated.

   o The height of the air stripping units would create an objectional structure and have an adverse impact on the aesthetics of the area.

EPA has stated that carbon adsorption is the best available technology for removal of organic compounds and since this process is allowed under Part 5 of the New York State Sanitary

Code, carbon adsorption was chosen as the method of treatment since it will remove the contaminants found in the raw water from the wells.

The noise and height factor eliminated air stripping from further consideration.

It is not possible to project the potential concentration of contaminants in the wells should the plume of contamination located upgradient of these public water supply wells eventually make its way to these wells. There is always the potential of a known or unknown plume of synthetic organic contaminants to contaminate a well. The supplier of water is well aware of this potential and is prepared to provide additional treatment at the site if the carbon adsorption units fail to provide adequate treatment.

Following are the contaminants found in the wells at the site:

Contaminant	MCL (ug/l)	Well 1 Concentrations (ug/l) 1989 1st	1989 2nd	1989 3rd	1989 4th	1990
Trichloroethylene	5	2	1	ND	0.5	ND
Tetrachloroethylene	5	1	1	1	0.5	1
Dibromomethane	5	ND	ND	3	ND	ND
Chloroform	100	ND	1	4	ND	ND
Bromodichloroemethane	100	ND	ND	2	ND	ND
Bromoform	100	ND	ND	3	ND	ND

DVIRKA AND BARTILUCCI

Contaminant	MCL (ug/l)	Well 2 Concentrations (ug/l) 1989 1st	2nd	3rd	4th	1990
Trichloroethylene	5	2	2	1	1	ND
Tetrachloroethylene	5	1	ND	ND	ND	ND
Dibromomethane	5	ND	ND	ND	ND	ND
Chloroform	100	ND	ND	ND	ND	ND
Bromodichloromethane	100	ND	ND	ND	ND	ND
Bromoform	100	ND	ND	ND	ND	ND

MCL = Maximum Contaminant Level
Note: ND = Not Detectable

You will note that there has been no increase in the concentrations of these contaminants since the beginning of 1989. It should also be noted that the trihalomethanes found in samples taken for the third quarter of 1989 were never found in samples taken prior to or subsequent to the third quarter (except for 1 ug/l of chloroform in the second quarter) leading us to believe that this was an anomaly, perhaps caused by laboratory error.

To design the system to remove contaminants which are present in a plume which may never affect the well would be unreasonable. If contamination from this plume does reach the well, additional treatment or modifications to the carbon adsorption system would be added based upon actual compounds present.

It is correct that the chloroform detected in well no. 1 will break through the bed in a short time; however, chloroform was not present in most of the samples leading us to conclude that it may be due to laboratory error. It should be noted that even if chloroform did break through the bed, that the concentrations shown in the testing results are well below the 100 ug/l MCL for this contaminant.

3. Methylene Chloride has never been found in any samples taken from these wells. If this compound does contaminate the raw water from these wells, a treatment system for its removal will be evaluated and installed.

It must be recognized that these wells meet all drinking water standards without any treatment. The Town of Hempstead Water Department is taking the prudent and conservative approach of providing treatment to remove the small amount of contamination present. The method used to remove the contamination is a proven process, acceptable under the State Sanitary Code.

We request a waiver from the Ten State Standards Policy Statement requirement to perform a cost analysis since the Town of Hempstead Water Department has made a decision to use carbon treatment, thus making the cost analysis unnecessary.

We will be contacting you to set up a meeting to discuss this letter so that these issues can be resolved as quickly as possible.

Very truly yours,

Nicholas Bartilucci

Nicholas J. Bartilucci

BY FEDP

NJB:ft

cc: Commissioner Daniel Davis, P.E.
Mr. Gilbert M. Faustel, PE, NYSDOH

RECEIVED
TOWN OF HEMPSTEAD
WATER DEPARTMENT
MERRICK, N.Y.
JUN 19 9 20 AM '90

Exhibit 4

THOMAS S. GULOTTA
COUNTY EXECUTIVE

NASSAU COUNTY
DEPARTMENT OF HEALTH
240 OLD COUNTRY ROAD
MINEOLA, NEW YORK 11501

John B. Branche, M.D.
COMMISSIONER F.A.A.P
FRANCIS V. PADAR, P.E., M.C.E.
DEPUTY COMMISSIONER FOR
ENVIRONMENTAL HEALTH

May 31, 1990

Mr. Nicholas J. Bartilucci, P.E.
Dvirka and Bartilucci
6800 Jericho Turnpike
Syosset, N.Y. 11791

Re: Granular Activated Carbon
Treatment at Wells Number 1
and Number 2
Bowling Green Water Distric
(NCDH File # 1431-90)

Dear Mr. Bartilucci:

This Department has received and reviewed the "Wells 1 and 2 Carbon Adsorpt System Design Report" prepared by your firm and offers the following commen for your consideration.

1. The report does not answer one of the more important concerns of the Department which was expressed in the Department letter of March 29, 1990 and the meeting of April 6, 1990. The submitted report does not provide a comparison with an alternative treatment process. The effectiveness and feasibility of carbon adsorption as compared with air stripping needs to be discussed.

2. The report lists high concentrations of synthetic organics detected in the monitoring wells in the vicinity of wells number 1 and 2. It also refers to a 1986 and a 1989 investigation predicting "a potential threat" to the wells. In view of the high concentrations witnessed in the vicinity of the wells, the selection of three times the recently recorded concentrations as the influent concentration of the system is questionable. Please explain your choice of design concentrations.

   It is interesting to know that even at these low concentrations, chloroform may break through in approximately 73 days. We mention this to show that GAC has its limitations in removing Chloroform and that existence of Chloroform in itself is not necessarily a valid argument against air stripping.

3. The report also falls short of discussing the possibilities of other contaminants present in the plume ever reaching the water supply. If Methylene Chloride, which has been detected in the plume, reaches the wells, an influent concentration as low as 6 ug/l will break through

the 120,000 pounds of carbon bed in less than a week. In other words, should Methylene Chloride in excess of the current MCLs be detected in the wells, the Water District will have to spend $150,000 every week in order to treat the water.

The Department strongly recommends against the installation of GAC units at this site until a complete study of alternative solutions is undertaken. According to our findings, adsorption may not necessarily be the most effective, feasible treatment for this particular site due to the quantity and characteristics of the contaminants found in the vicinity of the wells.

Please provide this office with a more detailed study of this situation so that the review of this project may continue. Please call me if you have any question concerning our comments or if you wish to meet to discuss the matter further.

Sincerely yours,

Shahriar Taj-Taraghi
Public Health Engineer I
Bureau of Public Water Supply

cc: New York State Department of Health
Attn: Mr. Gilbert M. Faustel, P.E.
Mr. George Philip, P.E.
Town of Hempstead Department of Water
Attn: Mr. Daniel Davis, P.E.

Doc # 5919I